SPACE FLIGHT ITEMS HANDLING REQUIREMENTS

CODE 549 AREAS

(BUILDINGS 7, 10, 15, 29 AND MAGNETIC TEST FACILITY)

PURPOSE:

The purpose of these documents are to establish a reference guide for critical hardware handling and operating of cranes in areas controlled by Code 549 (Environmental Test Engineering and Integration Branch). These documents are to help maintain Code 549 safety standards for project unique hardware lifting devices and equipment associated with critical lift operations, e.g., Lift Stability Analysis, Center of Gravity Analysis and Safety Analysis respectively.

SCOPE:

The scope of these documents is to serve as a guide and quick reference on handling of spacecraft and project unique equipment in the Code 549 area. These documents can be electronically down loaded and manipulated to meet most critical hardware needs or can be used as is. Appendages 1 and 2 are on computer and can be used to facilitate equipment readiness for testing.

REFERENCE DOCUMENTS:

Appendage - 1. Critical Lift Procedure Guidelines.

Appendage - 2. Procedures for Approval of Project Related Lifting Equipment.

INFORMATIONAL CONTACTS CODE 549:

Stanley Wojnar (Code 549), Phone 301- 286-5145

Charles England (Code 549.2), Phone 301- 286-3085

APPENDAGE - 1

CRITICAL LIFT PROCEDURE GUIDELINES

FOR

PROJECT UNIQUE HARDWARE

IN

CODE 549 AREAS

Note: **This is an example of a typical sign off page.**

Prepared By: _____

Reviewed By: _____

_____

Approved By: _____

_____

_____

TABLE OF CONTENTS

1.0 PURPOSE

The purpose of this document is to provide a Critical Lift guide for establishing project unique hardware procedures to be used at the Code 549 Environmental Test Engineering and Integration facilities (ETEI).

2.0 SCOPE

The ETEI test facilities are located at the Goddard Space Flight Center (GSFC), Buildings 7, 10, 15, 29, and the Magnetic Test Facility, Greenbelt, Maryland.

This procedure addresses critical lift operations for the ETEI facilities in accordance with the Mechanical System Center (MSC) Safety Manual. Critical lifts are defined in Section 4.0 below.

Cases may require the Project or another groups who have a need to prepare a test-item-unique, handling procedure. The test-item-unique handling procedure shall be approved by Code 549.

3.0 APPLICABLE DOCUMENTS

a) MSC Safety Manual:
http://www549.gsfc.nasa.gov/safety/FrameHome.htm

b) NPG 8715.3, NASA Safety Manual:
http://www.hq.nasa.gov/office/codeq/doctree/8715d2.htm

c) NASA Safety Standard for Lifting Devices and Equipment, NSS/GO-1740.9B:
http://www.hq.nasa.gov/office/codeq/doctree/s87199.htm

d) Certification and Recertification of Lifting Devices and Equipment, and Critical Lift Requirements, Goddard Management Instruction GMI 1710.6B:
http://mscdocsrv.gsfc.nasa.gov/GDMS_docs/GMI1000/GMI-1710.6B.pdf

e) Code 549 Procedure For Approval Of Project Related Lifting Equipment (NSI 12-02-932).

f) ESD Facilities & Capabilities Handbook, January 1995:
http://www549.gsfc.nasa.gov/cover.htm

4.0 CRITICAL LIFT DEFINITION

Per NSS/GO-1740.9B, Section 101c, critical lifts involve lifting and lowering operations with special, high dollar items, such as spacecraft, one-of-a-kind articles, or major facility components, etc., whose loss would have serious programmatic impact. Critical lifts also include operations with special personnel and/or equipment safety concerns beyond normal lifting hazards. (Examples: Test articles containing hazardous materials or pressurized components.)

The Project shall determine which test articles are to be defined as critical lifts. The Project shall fill in critical lift information in the appropriate checklist blanks on the Code 540 MSC System, Subsystem, or Equipment Evaluation Form. Critical lift requirements must be included in the planing process early in the test program so that timely cost estimates for the test can be prepared and unnecessary delays eliminated. The GMI 1710.6 requires that RECERT, prior to any lifting operation, certify all lifting devices and equipment.

5.0 CRITICAL LIFT PERSONNEL REQUIREMENTS

For critical lifts, the minimum crew is two. The crew may consist of a Critical Lift Coordinator (optional), a Critical Crane/Hydra-Set operator and Rigger. The Critical Lift Crane and Hydra-Set operators may be separate persons or the same person.

5.1 Critical Lift Coordinator: Shall be certified as required RECERT training course entitled: Critical Lift Coordinator Crane Training (6-hour course). In accordance with RECERT "Policy for Critical Lift Coordinator Certification July 8, 1999.

5.2 Crane/Hydra-set operator: Crane/Hydra-Set operator shall be certified as required by GMI 1710.6 and NSS/GO-1740.9B.

6.0 CRITICAL LIFT PERSONNEL PROTECTIVE EQUIPMENT REQUIREMENTS

Personal Protective Equipment (PPE) will be worn by personnel working within the confines of the lift safety zone as described in the MSC Safety Manual (Doc# 5405-048-98). The lift safety zone is defined by a roped off areas prior to the critical lift. When working with flight hardware, the authority to waive the use of hard-hats in specific instances when the following conditions are met:

> "Hard hats shall not be worn within six feet of flight hardware, unless protection is required from an identified head hazard, and the hazards cannot be eliminated or mitigated. Procedures allowing the removal of helmets shall contain a statement verifying

no head hazards are present, signed by quality assurance, safety or project management. If it is determined that helmets are required, the appropriate project representative shall be notified prior to the start of operations. Chinstraps shall be used if the possibility exists that the helmet could fall and impact another individual or hardware.

Where a possibility exists of injury to feet, foot protection that meets ANSI standard Z41 shall be worn. When working with heavy materials, steel-toed shoes are required. If there is a chance of puncture, puncture-resistant soles are required."

7.0 TOOLS, EQUIPMENT AND MATERIAL

Lifting devices and equipment shall be certified meeting the requirements of NASA Safety Standard for Lifting Devices and Equipment (NSS/GO-1740.9B), GMI 1710.6B and the MSC Safety Manual (Doc# 5405-048-98).

8.0 SPECIAL INSTRUCTIONS

8.1 Procedure Applicability: A project representative will verify that this procedure is appropriate for the critical lift to be conducted. The project representative should annotate or rewrite this procedure to encompass the particular needs of the critical lift.

8.2 Quality Assurance (QA)/Safety Monitoring: The Work Directive, or Code 549.1 engineering, within the guidelines of the appropriate safety manual shall state whether QA and/or Safety personnel must witness the lifting operation. If so, the lift coordinator shall arrange to have the appropriate personnel present before starting lifting operations.

8.3 Stability Analysis: A stability analysis is required for critical lifts. The project provides a stability analysis of the test item under lifting conditions together with unique slings/hardware, special lifting configurations, and handling considerations mandatory for the lift.

8.4 Hydra-set Requirement: A hydraset can be used for critical lifts however, this is a decision each project should make. Hydra-Sets requires checkout and exercising prior to use and must be used within twenty-four hours after exercising. The hydraset operator is a Certified Critical Lift Crane operator. The operator may be the same person as the crane operator.

8.5 Grounding Requirement: The project engineer shall inform the facility test engineer whether grounding straps are needed. The lift coordinator or operator shall verify the grounding leads are attached properly and are able to travel with the load with no interference. The requirement for lift personnel to use electrostatic discharge wrist-stats shall be clearly stated in the procedures.

8.6 Emergency Conditions: In the event of building evacuation, electrical power outage or crane failure the crane shall be shut off, and locked out. If personnel will not be placed in danger, the lift coordinator shall ensure the area is roped off and marked with signs warning of the overhead load. Resume this procedure after the emergency condition has been corrected.

9.0 LIFTING PROCEDURE

9.1 Personnel Assignments: All personnel involved in a hazardous operation must be listed in the approved procedure. (See Section 5.0 for certifications required.) List the names of designated personnel for this lift in the spaces below:

Lift coordinator or task leader_____

QA rep. _____

Lift operator_____

Safety rep. _____

Hydra-set operator _____

Other (specify) _____

Project rep. _____

Rigger_____

9.2 Preliminary Checklist Items: Check the applicability of the following items before starting the lift operation:

Test-item-unique procedure provided? [ ] yes [ ] no

QA rep. required? [ ] yes [ ] no

Safety rep. required? [ ] yes [ ] no

Stability analysis completed? [ ] yes [ ] no

Stress analysis completed? [ ] yes [ ] no

Hydraset ready (If required)? [ ] yes [ ] no

Grounding straps in place (If required)? [ ] yes [ ] no

Other special requirements? (Specify) [ ] yes [ ] no

9.3 Establish a lift safety exclusion zone defined by barriers or roped off areas. Prevent unauthorized personnel from entering the zone. This zone shall be at least 25-ft. radius from the item being lifted, whenever possible.

Coordinator or task leader _____

9.4 Verify all members of the lift team are wearing appropriate personal protective equipment.

Coordinator or task leader _____

9.5 Conduct pre-task briefing and assign jobs to personnel. Verify that lift operators and coordinators have valid GSFC certifications or licenses.

Coordinator or task leader _____

9.6 List all the lifting equipment needed for this job in Table 9.6 below (enter N/A if the item is not applicable). Verify GSFC RECERT has certified all lifting equipment used for the lift within the past twelve months. Verify there is no damage.

Coordinator or task leader _____

Table 9.6 Lifting Equipment Description				
Item	**Part Number**	**Capacity/Length Quantity/Etc.**	**Control No.**	**Cert. Due Date**
Crane				
Hydraset				
Lifting sling assembly				
Shackles				
Load cell				
Wire rope (# of legs)				
Nylon straps				
Hoist rings				
Turnbuckles				
Tag lines				

9.7 Perform engineering/safety walk down of the area.

Coordinator or task leader _____

9.8 Verify/Perform the daily checkout of the crane and/or hydraset and sign log book.

Coordinator or task leader _____

9.9 Visually inspect all lifting equipment for GSFC certification, damages and proper configuration.

Coordinator or task leader _____

9.10 Attach the Hydra-Set (If required) to the crane hook using the appropriate lifting hardware as specified in **Table 9.6.**

Coordinator or task leader _____

Caution: If there is any uncertainty of the weight of the test item, a load cell shall be used.

9.11 Attach the load cell (if required) using the appropriate hardware.

Coordinator or task leader _____

Warning: The following steps are hazardous because of the lifting operation. No personnel shall be allowed to work or walk beneath a suspended load.

9.12 Issue verbal warning that hazardous crane operations are ready to begin. Remove all unauthorized personnel from the lift exclusion zone.

Coordinator or task leader _____

Safety concurrence to proceed (if applicable) _____

Note: Sign not applicable (N/A) to the following two steps if a load cell and/or Hydra-Set is not to be used in the following steps.

9.13 Connect the lift sling to the load cell using the appropriate hardware. Install the lift sling in the appropriate lifting configuration. Record the weight of the lift sling.

Lift sling = _____lb.

Coordinator or task leader _____

9.14 Using the crane, raise and translate the lift sling over the item to be hoisted and attach the lift sling to the item using the appropriate hardware.

Coordinator or task leader _____

Caution : Verify SWL before proceeding.

9.15 Using the hydraset and/or crane, raise the test item. Record the calculated (or expected) item weight and the actual item weight (as measured by the load cell or hydraset) in the spaces below:

Calculated (expected) weight = _____lb

Actual weight = _____lb Coordinator _____

9.16 Using the hydraset and/or crane, translate and lower the test item to its specified location.

Coordinator _____

9.17 Secure the item prior to disconnecting. Disconnect and remove the sling from the item.

Coordinator _____

9.18 Store all lifting equipment, stow crane and lock crane electrical power box. Restore the exclusion zone to normal.

Coordinator _____

10.0 ADDENDUM TO CRITICAL LIFT PROCEDURE

Red lining of this procedure is authorized and should be coordinated through the project person signing off on the procedure as well as the critical lift team. Good judgment and safety should always be of primary concern. Changes to the hazard level require Safety approval prior to being performed. (This is a NPG 8715.3 requirement.)

APPENDAGE - 2

PROCEDURE FOR APPROVAL

OF PROJECT UNIQUE LIFTING EQUIPMENT

Note: This is an example of a typical sign off page.

Prepared By: _____

Reviewed By: _____

Approved By: _____

_____

_____

Table of Contents

1.0 PURPOSE

The purpose of this procedure is to provide the process through which project unique lifting equipment used in Code 549 cognizant areas are certified to lift critical hardware.

2.0 SCOPE

This document is written to help ensure all lifting hardware used in the MSC facilities is built to RECERT standards.

3.0 DEFINITIONS

3.1 Rated Load: The maximum working load, demonstrated by a proof test, the lifting device and equipment was designed and certified to operationally handle.

3.2 Proof Load: The load applied to lifting device and equipment, at a prescribed value larger than the rated load for certification purposes. See NSS/GO 1740.9B, Table 8-1.

3.3 NDE: Nondestructive Examination performed by a qualified NDE Inspector.

3.4 Waiver: A waiver authorizes a departure from the required documented requirements. Lifting Devices and Equipment (LED) waiver must be endorsed by the Flight Project Manager and approved by

RECERT or higher as appropriate. Waver request must be prepared and approved in accordance with RECERT policy.

3.5 Lifting Equipment: Items such as slings, turnbuckles, strongbacks, shackles, spreaders, etc., used to attach the load to the lifting device.

3.6 Lifting Device: Machines such as cranes, hoists, Gantries, Mobile Cranes etc., used for lifting, lowering and moving a load.

3.7 Certification: The process that the RECERT uses to assure equipment used for lifting project related hardware is safe. Personnel who operates cranes, performs rigging, and coordinate lifts are trained and qualified meeting GSFC requirements.

3.8 Loads Analysis: An analysis, which calculates the actual force, generated at the lift point or at each lift point in a multi-point sling for a particular lift.

3.9 Stress Analysis: An engineering strength analysis of all of the elements of the lifting equipment. Calculations shall include the materials, equations, factors of safety, bending stress, tear out, etc. A table of all elements and their factor of safety shall be prepared. The load analysis and lifting equipment drawings shall form the basis for these calculations. An analysis shall include the load path on flight hardware when fittings are used for ground handling to ensure adequate safety factor.

3.10 Stability Analysis: An analysis of a specified lift configuration performed in accordance with NSI Procedure No. NSI 15-01-422.

4.0 VALIDATION REQUIREMENTS

All projects lifting equipment used in Code 549 spaces must be reviewed for certification by RECERT regardless of the source of the device or project.

5.0 REFERENCES

a) NASA Safety Standard for Lifting Devices and Equipment, NSS/GO-1740.9B: http://www.hq.nasa.gov/office/codeq/doctree/s87199.htm

b) Certification and Recertification of Lifting Devices and Equipment, and Critical Lift Requirements, Goddard Management Instruction GMI 1710.6B: http://mscdocsrv.gsfc.nasa.gov/GDMS_docs/GMI1000/GMI-1710.6B.pdf

c) OSHA CFR 29 Part 1910.184, "Slings." http://www.osha-slc.gov/OshStd_data/1910_0184.html

d) NPG 8715.3, "NASA Safety Manual": http://www.hq.nasa.gov/office/codeq/doctree/8715d2.htm

e) MSC Safety Manual: http://www549.gsfc.nasa.gov/safety/FrameHome.htm

6.0 REQUIRED DOCUMENTS/ANALYSES

6.1 Loads Analysis: Load analysis shall include the center of gravity of the payload and all load vectors at each lift point. It shall be used to design the proof test or evaluate the adequacy and appropriateness of a previous proof test. A separate load analysis shall be performed for each service configuration of the lifting equipment.

6.2 Stress Analysis: Stress Analysis document shall contain detailed strength/stress calculations of each element of the lifting equipment. In accordance with Code 549 policy all elements must be designed with a factor of safety of three on yield and five on ultimate. A summary table of all elements of the lifting equipment and their factors of safety shall be included in the document. Waivers for elements not meeting Code 549 design criteria must be included with the document and approved by 549 Branch Head.

6.3 Stability Analysis: A stability analysis of the lifting equipment/payload combination for each specified configuration shall be performed in accordance with MSC Safety Manual.

6.4 Proof Test: A proof test which provides loads at all lifting points which exceed the rated load in accordance with the latest version of NSS/GOI740.9 shall be performed on each specified lifting equipment/payload configuration. Following the proof test and NDE, when required, the lifting equipment shall be tagged in accordance with NSS/GO1740.9. Multiple configurations of the lifting equipment must be proof tested for all service configurations.

7.0 PROOF TESTING OF PROJECT UNIQUE HARDWARE

Project lifting and handling hardware proof tested by other than RECERT must have the documentation reviewed by RECERT for approval and acceptance.

RECERT group or project shall prepare a procedure for each proof-test, which includes the specifications for the proof-test maximum applied load, and have it approved by RECERT and Project. All Project Unique Hardware shall be designed with a safety factor of 3.0 on yield and 5.0 on ultimate (This is a NSS/GO 1740.9 requirement) based on a formal stress analysis. Any item with a factor of safety less than 3.0/5.0 requires a formal waiver approved by RECERT and Branch Head.

8.0 RESPONSIBILITIES

8.1 Flight Projects: Flight projects are responsible for creating and supplying the required analyses and documentation of the lifting equipment for their flight, proto-flight and Engineering Test Unit (ETU) hardware.

8.2 Branch Head (Code 549): The Branch Head is responsible for informing all Code 549 organizational elements and Projects of the requirements of this procedure, enforcing its requirements, and approving waivers from these procedures.

8.3 Environment Project Engineering Section (Code 549.1): Code 549.1 will provide liaison and a copy of this document to Flight Projects and reimbursable customers prior to the arrival of flight hardware at GSFC. Ensures that all of the required documentation is submitted to Code 549.2 prior to any scheduled project lift. In the event the required documentation is not submitted, makes the necessary arrangements with the Project/reimbursable customer and Code 549.2 to complete the required analyses and tests.

8.4 Recertification Program Manager (RECERT): RECERT performs proof tests and periodic load test on project lifting equipment, as required. Designs lifting equipment and performs/reviews load test, stress, loads, and stability analyses, as required. Ensures that lifting equipment is certified in accordance with NSS/GO-1740.9B and affixes a certification tag to the lifting equipment upon completion of all requirements. Maintains a file of all documentation pertaining to validation of lifting equipment.